NATIONAL MUSEUM OF THE UNITED STATES AIR FORCE™

A BIRD'S EYE VIEW / REMOTE SENSING-Part 3

Students will learn what remote sensing is and how it was developed, from the early years of 'pigeon photography' to the latest in satellite imagery. They will also develop an awareness of how things are interpreted within the realm of aerial photography!

LESSON PLAN—Part 3

Learning Objectives

The students will

- Learn about the development of remote sensing with respect to the five senses, focusing on sight
- Learn how to change their thought processes about how objects look from far above (not very easily done)
- Learn how to sketch familiar objects—not how they look from the typical 'side/personal view,' but from a perspective which is high above the object in question
- Understand how and why we changed our mindset from the normal vision of the world (eye level) to that of an aircraft flying in the sky (there are many advantages)
- Develop an understanding of how to interpret photo- graphs taken from birds, kites, rockets, hot air balloons, aircraft, satellites and spacecraft—and how to interpret textures, colors, geometric shapes, shading and shadows

Introduction/Background

Remote sensing was initially introduced in the late 1950s, and prior to that aerial photography was used and more apropos. Simply stated, remote sensing is the science and acquisition of information about a particular object (identifying, measuring or observing) without making direct, physical contact with that object. Although several of our five senses may be amplified and/or reconfigured to be used in a remote sensing role, for the purposes of this lesson plan, the focus will be on the sense of sight. The history of remote sensing (from the "bird's eye view" perspective) began with the invention of photography. The very first aerial photo was taken in 1858 from a hot air balloon that was floating about 1,200 feet above Paris. During the Civil War, observations were done from balloons for military purposes, and it is also possible that photographs were taken as well. In 1903, the Bavarian Pigeon Corps used pigeons to take aerial photos over Europe. The cameras which were strapped to them were activated by timing mechanisms. Cameras were affixed to kites to photograph the San Francisco earthquake of 1906. During World War I, aerial photography was accomplished from airplanes, as it was during World War II (although, more sophisticated techniques existed).

Grade Level: 2—4

Ohio Learning Standards/Science (2018)
Expectations for Learning
Nature of Science

Earth and Space Science
4.ESS.1: Earth's surface has specific characteristics and landforms that can be identified.

Ohio Learning Standards/Fine Arts (2012)
Fine Arts: Grade 3:
3PR: Find and solve problems of personal relevance and interest when developing art making ideas
4PR: Create artworks that demonstrate awareness of two- and three-dimensional space.

Ohio Learning Standards/Social Studies (2019)
Grades 2 through 4:
History: Historical Thinking and Skills
Geography: Spatial Thinking and Skills

Ohio Learning Standards/Mathematics (2017)
Geometry:
2.G: Reason with shapes and their attributes
3.G: Reason with shapes and their attributes

Materials Required:

- Board and markers
- Laptop, monitor, digital projector
- Paper and pencils for each student
- Clean, empty pop can for each student
- Two sheets of 3X3 sticky notes per student
- One 18-inch piece string per student
- Four small round stickers per student

And the first photographs of Earth from space were made by a camera riding aboard an American-launched V-2 rocket in 1946. After World War II ended, a climate of distrust and political unrest existed between the Soviet Union and the United States—the Cold War. The very first overflight of the Soviet Union by a U-2 spy plane was in 1956, and this aircraft did an adequate job taking secret, aerial reconnaissance photos for the Central Intelligence Agency (CIA) for several years. However, on May 1, 1960, Francis Gary Powers was shot down by surface-to-air (SAM) missiles while flying over the Soviet Union, and our secret reconnaissance missions were exposed. President Eisenhower was forced to admit to our aerial spying.

CORONA Program satellites, first launched in 1960, contained the first American high-resolution space reconnaissance system (the American public didn't know of the program's existence until 1995 when it was finally declassified – it was known to the public at the time as the Discoverer XIV research program). The first satellites in this program took photographs of wide swaths of land to identify items such as airfields and missile sites of foreign military and nuclear powers. But we still needed an aircraft to replace the U-2 that would help us see if the Soviet Union, as well as other countries, was developing the types of weapons that could be used against us. It would have to be a long-range, supersonic, photo-reconnaissance aircraft. It would have to be able to fly faster than Mach 3 (more than three times the speed of sound) for hours at a time. It would have to reach an altitude in excess of 85,000 feet (over 16 statute miles). It would have to be able to photograph up to 100,000 square miles of the Earth's surface per hour. Such an aircraft could fly high enough and fast enough to avoid SAM missiles, and it could also fly higher and faster than any enemy fighters or interceptors.

The CIA turned to the makers of the U-2, Lockheed Martin's "Skunk Works" in Burbank, California, to design and build this aircraft. The first of these very special aircraft were designated A-12s, and they were three decades ahead of any other jet airplanes. These "Blackbirds" first flew at the secretive Area 51 in Nevada, in April of 1962. In July of 1964, President Johnson announced the SR-71 Blackbird Program to the world—and every aforementioned requirement was met or exceeded by the SR-71. In the 1960s and early 1970s, Gemini and Apollo astronauts took hundreds of photographs of the Earth, the moon and space from their spacecraft and from the moon! And between 1971 and 1986, HEXAGON KH-9 reconnaissance satellites were the largest (and last) U.S. intelligence satellites to return photographic film to earth. During the Cold War, 19 HEXAGON missions imaged 877 million square miles of the Earth's surface. In 1972, the first Earth Resources Technology Satellite (ERTS-1) was launched by the National Aeronautics and Space Administration (NASA). It was later renamed Landsat-1, and its primary objective was to obtain information on agricultural and forestry resources, land cover, land use, geology and mineral resources, hydrology and water resources, environmental pollution and marine resources! In the late 1990s, the USAF started flying the unmanned Predator vehicle which used satellite data links to gather information which could be shared instantaneously with commanders around the world. About the same time, the US first flew another unmanned aerial vehicle, the Global Hawk, with its powerful digital camera and infrared sensor that can gather imagery in any weather condition, day or night. Through satellite links and ground relay stations, that information is transmitted immediately anywhere in the world. Its "Synthetic-Aperture Radar/Moving Target Indicator" lets ground crews track even small, moving objects on the ground. In 2001, Google Earth was released – a computer program that provides a 3-D representation of our planet based primarily on satellite imagery and aerial photography!

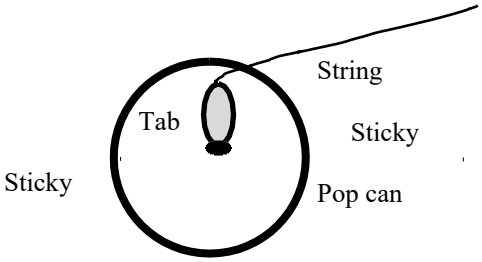
Procedures for Lesson Plan-Part 3

- Start with Slide 13 from the available slide presentation. Tell the class that in 2011, the National Reconnaissance Office declassified several top secret spy satellites, and they became exhibits at the National Museum of the United States Air Force! Show slide 13, and tell them the photo is of the largest U. S. spy satellite, the KH-9, also known as 'Big Bird!' 'Big Bird' was sixty feet long (about the length of a school bus) and had a ten-foot diameter! It took pictures as it orbited from 80 to 370 miles above the Earth, and the film itself was sixty MILES long! In orbit, it used solar arrays/solar panels to generate power from sunlight. "Big Bird' did spying for us (aerial reconnaissance) while flying over other countries. Ask the students how they think we were able to retrieve the film-return capsules (and the important film) after they parachuted close enough to the Earth. With air planes and a parachute-snagging hook system!
- Show the class slide 26 and tell them this is a satellite image of a famous large city (New York City and its environs.) Ask them what they see (answers may include rivers, a large body of water at the bottom of the photo, green and brown areas, etc.). The next slide shows a lot more detail of the same area, and the smallest of the three islands in the center of the photograph is Liberty Island, home of the Statue of Liberty! Ask students if they can see the boats moving around within New York Harbor!
- Show the students the next slide and tell them that this is a satellite image of another famous, large city (don't tell them that it is Washington, D.C. quite yet). Ask them what they see (answers may include a river, bridges, trees, buildings, etc.). Tell them to concentrate on the island in the upper left corner of the satellite photo, and then move directly to the right almost to the center of the photo—have them look for a dark, circular shape. Show the next slide and tell them that this is the same city shown much closer. They should be able to see that the circular shape is now in the upper right-hand corner of this photo (don't tell the class yet, but the circle is the White House South Lawn). There is a large building shown just above the circle and this building is right at the top edge of the image. Ask students what they think the famous building might be (the White House). Have the class analyze what they see across the bottom of the satellite photo (from left to right: the Lincoln Memorial, the Reflecting Pool, the World War II Memorial and the Washington Monument)! Skip the last slide.

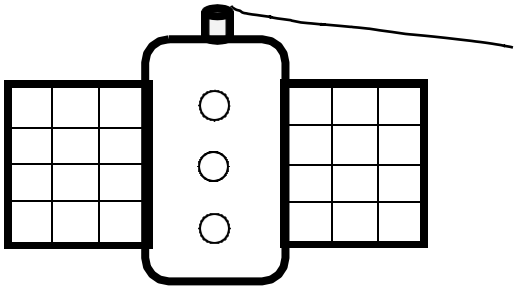
Tell the class that it is now time to build their spy satellites!

- Pass out the materials for this fun activity. Each student should have two 3" x3" sticky notes (preferably the extra sticky kind), one clean empty pop can with the tab still attached, one 18" length of string, a pencil and three or four white or multi-colored sticky back circles. Be prepared to show students each and every step with your own model in front of the classroom.
- **Step one**: have the students carefully bend the tab on their pop can up so that it is nearly perpendicular with their desk or table surface.
- **Step two**: students should tie one end of their string to the top of the tab and use three knots for security (this will allow students to hang their 'satellites' in your classroom or in their room at home).
- **Step three**: ask the students to use a pencil to draw 'tic-tac-toe' crossing lines on each side of both of their sticky notes—tell them that these represent the satellite's solar panels (which create electrical power from sunlight).
- **Step four**: students should bend the sticky notes just below the sticky part so that they form an 'L' shape.
- **Step five**: have students attach the sticky notes to their pop can so that they are on the opposite sides of the can (the shorter portion of the sticky note 'L' shape has the adhesive on it, and that is what adheres to the surface of the 'satellite'). Each sticky note should be pointing outward to replicate actual solar panels.
- **Step six**: students may wish to place their three or four white sticky back dots (which represent the cameras on their 'satellite') on one side of their pop can, or they may wish to affix them in a completely different pattern—it is totally up to them! The following illustrations show a 'satellite' from both a bird's eye view and a side view.

Birds Eye View



"Side View"



Assessment/Evaluation
The students should be evaluated on their class participation and contributions, listening skills and ability to follow verbal instructions (especially during the satellite building portion of Lesson Plan –Part 3).

Extension
Ask students (either individually or in small, designated teams) to research satellites and remote sensing (both past and present). Allow time for them to share what they have discovered at a later date.

Resources:

NASA's Amelia the Pigeon website: https://science.nasa.gov/adventures-amelia-pigeon

Another lesson plan using Amelia the Pigeon:
https://www.univie.ac.at/geographie/fachdidaktik/FD/site/external_htmls/imagers.gsfc.nasa.gov/amelia/index.html
And the teacher guide:
https://www.univie.ac.at/geographie/fachdidaktik/FD/site/external_htmls/imagers.gsfc.nasa.gov/amelia/teachersguide/lessonsK_2/K-2Lesson1.html

ERTS: https://landsat.gsfc.nasa.gov/landsat-1/

Google Earth: https://www.google.com/earth/

Background resources from the National Museum of the USAF (https://www.nationalmuseum.af.mil/):

- Homing Pigeon: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197423/USAFmuseum/
- U-2: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/195974/lockheed-u-2a/
- SR-71: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/198054/lockheed-sr-71a/
- Reconnaissance Satellites:
    - https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/198108/discoverer-xiv/
    - https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/195920/gambit-1-kh-7-reconnaissance-satellite/
    - https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/195922/gambit-3-kh-8-reconnaissance-satellite/
    - https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/195921/hexagon-kh-9-reconnaissance-satellite/
    - https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/589823/teal-ruby/

A ‘BIRD’S EYE VIEW’ (REMOTE SENSING)

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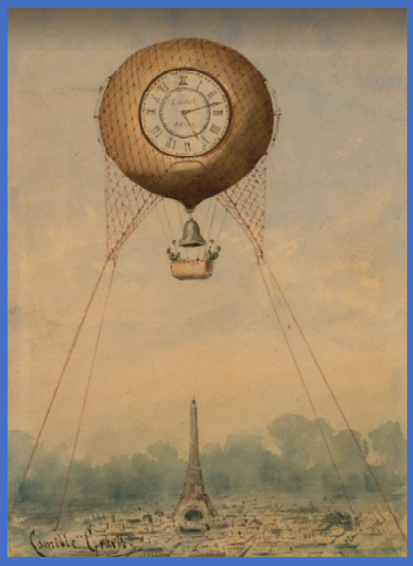
Remote sensing initially introduced in the late 1950’s, and prior to that, aerial photography was used and more apropos. Simply stated, remote sensing is the science and acquisition of information about a particular object (identifying, measuring or observing) without making direct, physical contact with that object. Although several of our five senses may be amplified and/or reconfigured to be used in a remote sensing role, for the purposes of this lesson plan, the focus will be on the sense of sight. The history of remote sensing (from the “bird’s eye view” perspective) began with the invention of photography.

Balloons Were Used for Aerial Reconnaissance



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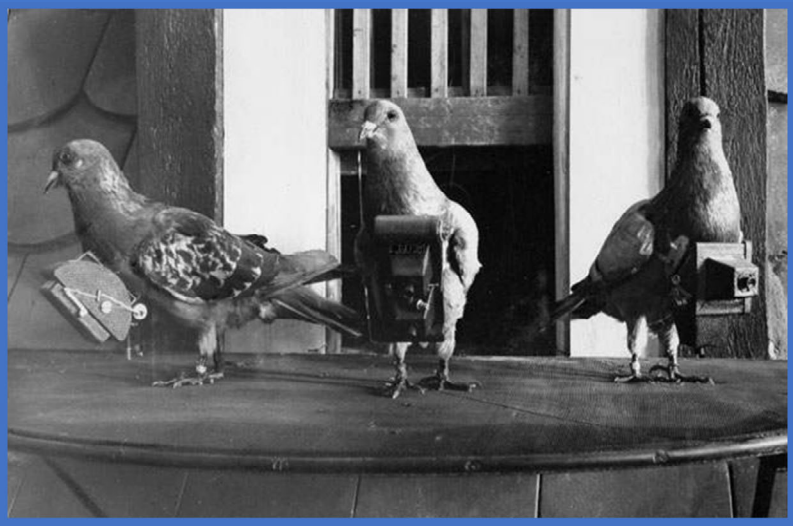
The very first aerial photo was taken in 1858 from a hot air balloon that was floating about 1,200 feet above Paris. During the Civil War, observations were done from balloons for military purposes, and it is also possible that photographs were taken as well.

Pigeons Outfitted With Cameras



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In 1903, the Bavarian Pigeon Corps used pigeons to take aerial photos over Europe. The cameras which were strapped to them were activated by timing mechanisms.

Camera Suspended Under A Kite

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Cameras were affixed to kites to photograph the San Francisco earthquake of 1906.

Photo Taken From A Kite (1906)

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WW I Aerial Photography

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A British aerial photographer, WW I

During World War I, aerial photography was accomplished from airplanes, as it was during World War II (although, more sophisticated techniques existed).

WW II Aerial Photography

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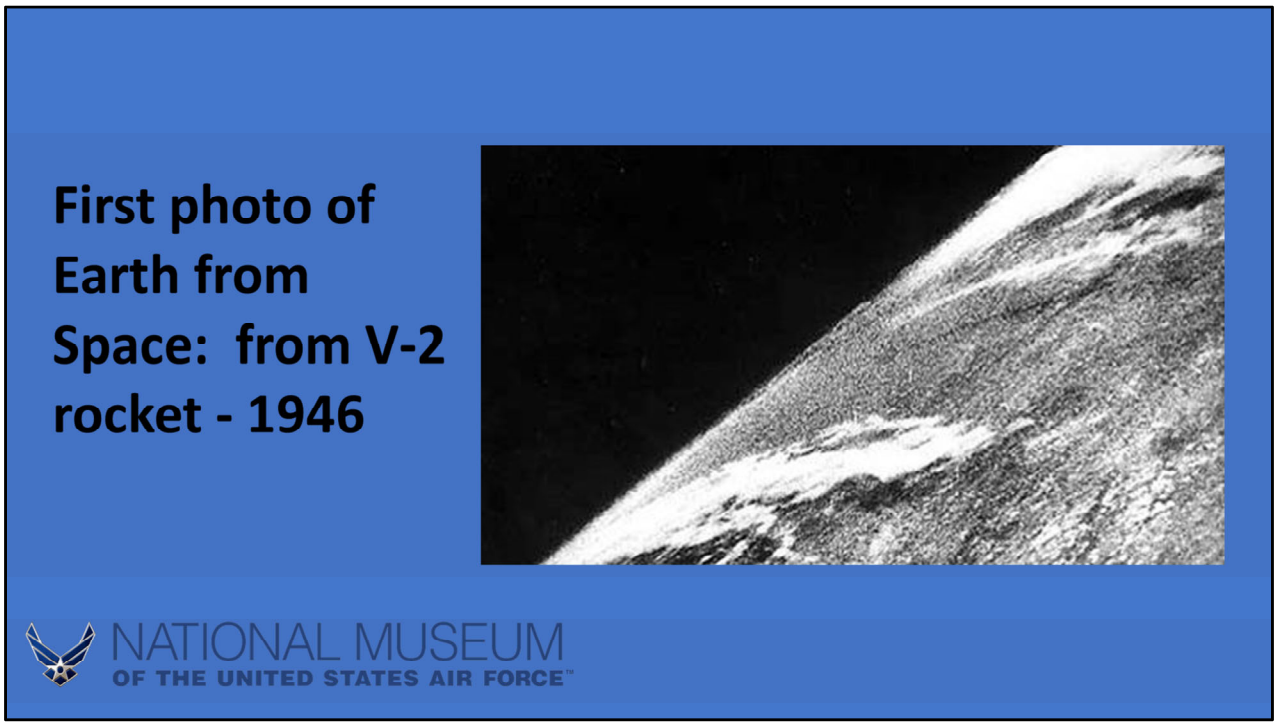
Reconnaissance photos show Peenemunde, site of German World War II rocketry research. Arrow indicates V-2 rocket lying on its side. Photos such as these helped Allies to understand the nature of reported new German "secret weapons" research.



Alfred Nobel, the Swedish millionaire who originated the world's most prestigious science prizes, was also a compulsive tinkerer and filer of patents. Among the fields that caught his interest was rocketry, perhaps not surprising for the man who invented dynamite.

Nobel wasn't the first to think of launching a camera on a rocket, but in 1896 he filed a patent for "an improved mode of obtaining photographic maps" from aerial platforms, including rockets. Each rocket firing would produce one picture, which the camera would snap while parachuting back to the ground. To control when the shutter released, he used a time fuse instead of a clock.

Nobel died in Dec. of that year, but engineers at his research lab in Karlskoga, Sweden took the idea forward, and within a few months had built a prototype. On April 26, 1897, their rocket camera took two photographs looking down on the town of Karlskoga.

Since then, most people have assumed the pictures were taken from a rocket, since it was, after all, a rocket camera. The trouble is, there was no account of the device being launched, even though Nobel's staff kept detailed records.

Now Swedish-born aerospace engineer Ingemar Skoog thinks he's figured out why. Based on the location of buildings in the photos, some of which still exist, he thinks the pictures were most likely taken from a high hill overlooking Karlskoga. Skoog, who reports his findings in a recent issue of *Acta*

Astronautica, figures that the two rocket camera images, which are nearly identical, would have been very different in angle and perspective had they been taken from cameras swinging from parachutes after separate launches. His conclusion: The camera was probably fixed to a static mount during a ground test. And there's no evidence it was ever launched on a rocket. Still, Nobel gets credit for a good idea. And no doubt he would have been pleased by V-2 rocket photos of the Earth taken half a century later (image on this slide is from V-2 rocket in October 1946).

After World War II ended, a climate of distrust and political unrest existed between the Soviet Union and the United States—the Cold War. The very first overflight of the Soviet Union by a U-2 spy plane was in 1956, and this aircraft did an adequate job taking secret, aerial reconnaissance photos for the Central Intelligence Agency (CIA) for several years. However, on May 1, 1960, Francis Gary Powers was shot down by surface-to-air (SAM) missiles while flying over the Soviet Union, and our secret reconnaissance missions were exposed. President Eisenhower was forced to admit to our aerial spying.

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The Museum's C-119J Flying Boxcar made the world's first mid-air recovery of an object returning from space. In August 1960, it caught the Discoverer XIV satellite using recovery gear lowered from the open rear door. This mechanism snagged the satellite's parachute, and a winch slowly reeled the film capsule into the aircraft. "Satellite catching" became an important and regular U.S. Air Force operation to recover secret reconnaissance satellite film.

But we still needed an aircraft to replace the U-2 that would help us see if the Soviet Union, as well as other countries, were developing the types of weapons that could be used against us. It would have to be a long-range, supersonic, photo-reconnaissance aircraft. It would have to be able to fly faster than Mach 3 (more than three times the speed of sound) for hours at a time. It would have to reach an altitude in excess of 85,000 feet (over 16 statute miles). It would have to be able to photograph up to 100,000 square miles of the Earth's surface per hour. Such an aircraft could fly high enough and fast enough to avoid SAM missiles, and it could also fly higher and faster than any enemy fighters or interceptors.

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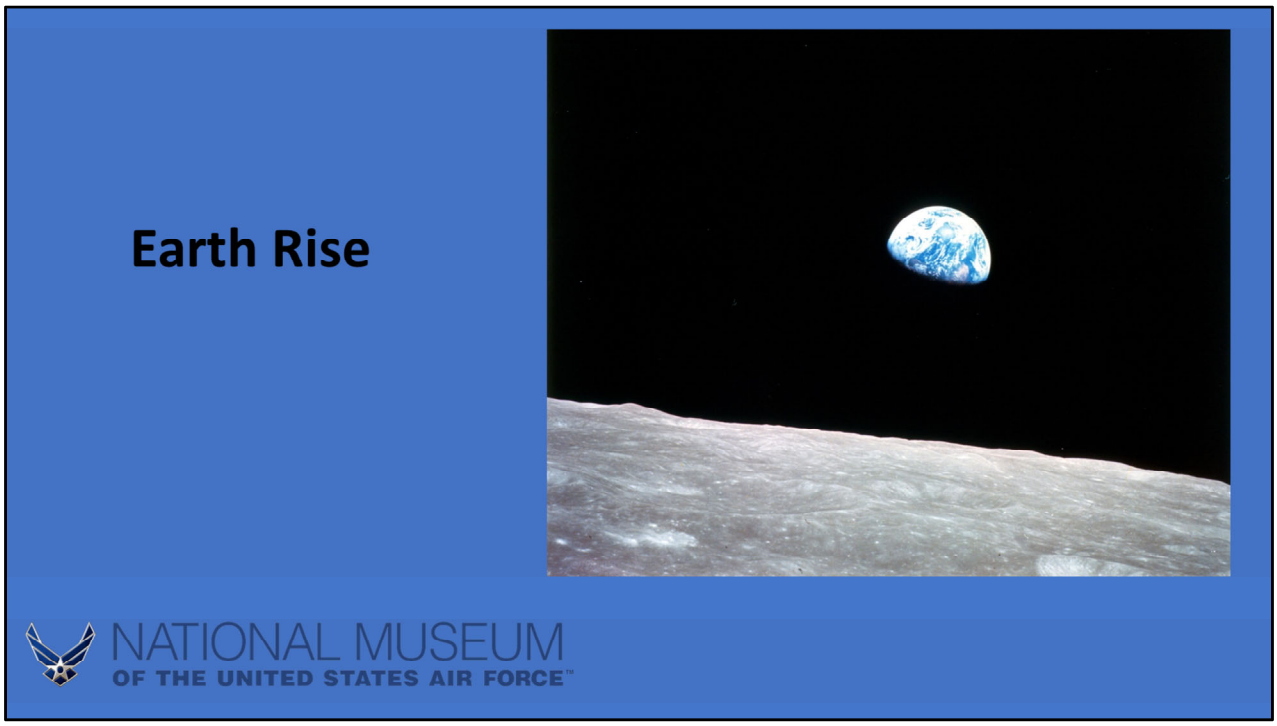


In the 1960's and early 1970's, Gemini and Apollo astronauts took hundreds of photographs of the Earth, the moon and space from their spacecraft and from the moon!

Apollo 8, the first manned mission to the moon, entered lunar orbit on Christmas Eve, Dec. 24, 1968. That evening, the astronauts-Commander Frank Borman, Command Module Pilot Jim Lovell, and Lunar Module Pilot William Anders-held a live broadcast from lunar orbit, in which they showed pictures of the Earth and moon as seen from their spacecraft. Said Lovell, "The vast loneliness is awe-inspiring and it makes you realize just what you have back there on Earth." They ended the broadcast with the crew taking turns reading from the book of Genesis.

Image Credit: NASA

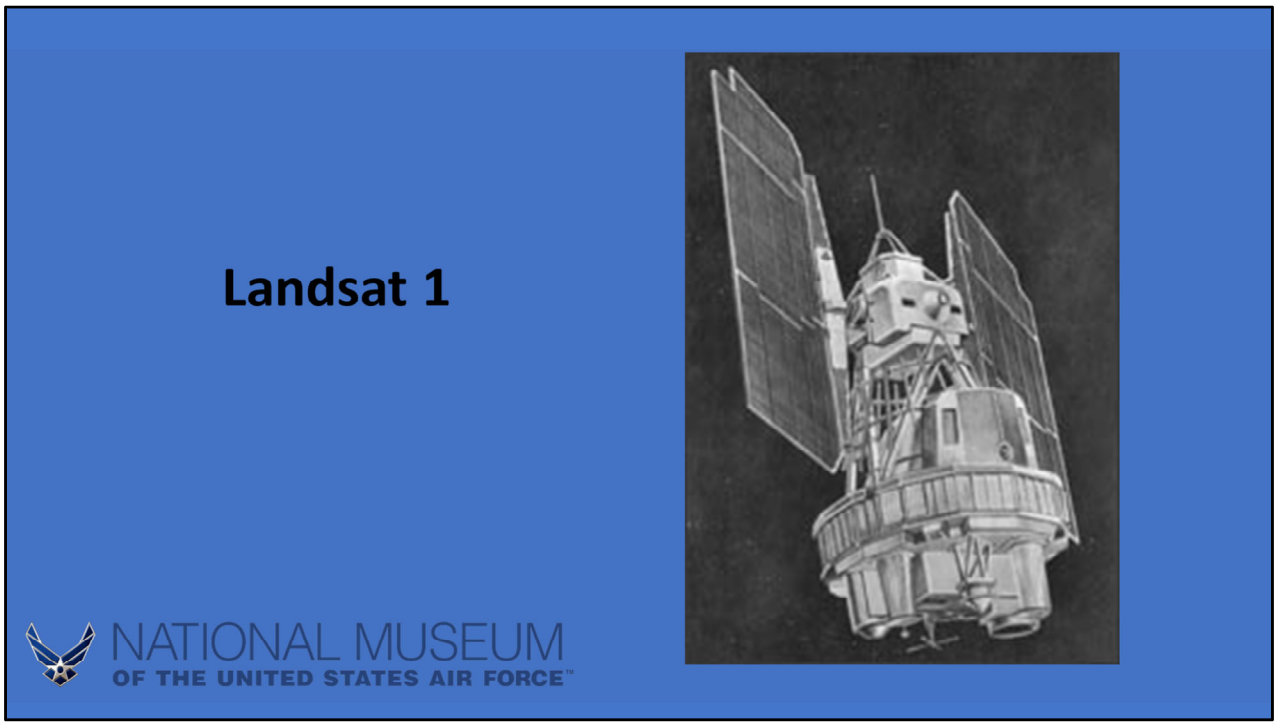
HEXAGON KH-9 reconnaissance satellites were the largest and last U.S. intelligence satellites to return photographic film to earth. During the Cold War, 19 HEXAGON missions imaged 877 million square miles of the Earth's surface between 1971-1986.

HEXAGON's main purpose was wide-area search. Analysts pored over HEXAGON's photos of large areas, then focused in on potential threats with close-up surveillance from GAMBIT satellites.

The Lockheed Corp. built the HEXAGON vehicle. Its development included creating a very complex camera and film system. The satellite featured two separate cameras, designated KH-9 and made by the Perkin-Elmer Corp., working together to produce stereo images. These so-called "optical bar cameras" on the bottom of the satellite spun on their axes, taking overlapping images to form a very large panoramic picture. Objects smaller than two feet across could be imaged from around 80-100 miles altitude.

Some missions included a separate mapping camera mounted at the front of the satellite. This camera imaged wider areas to make very accurate maps for war planning and featured its own bucket-like film return vehicle.

The U.S. Air Force launched HEXAGON satellites aboard Titan IIID rockets from Vandenberg AFB, California, and provided tracking and control at an Air Force facility at Sunnyvale, Calif. USAF aircraft recovered film return vehicles in midair near Hawaii.



Landsat 1 was launched on July 23, 1972; at that time the satellite was known as the Earth Resources Technology Satellite (ERTS). It was the first Earth-observing satellite to be launched with the express intent to study and monitor our planet's landmasses.

To perform the monitoring, Landsat 1 carried two instruments: a camera system built by the Radio Corporation of America (RCA) called the Return Beam Vidicon (RBV), and the Multispectral Scanner (MSS) built by the Hughes Aircraft Company (El Segundo, CA; NASA contract NAS 5-11255).

The RBV was supposed to be the prime instrument, but the MSS data were found to be superior. In addition, the RBV instrument was the source of an electrical transient that caused the satellite to briefly lose altitude control, according to the Landsat 1 Program Manager, Stan Weiland.

Sketch of the Landsat 1 satellite.

The MSS instrument was flown as the secondary and highly experimental instrument. "But once we looked at the data, the roles switched," relates Stan Freden, Landsat 1 Project Scientist.

The MSS recorded data in four spectral bands—a green, red, and two infrared bands.

To help understand the data and to explore the potential applications of this new technology, NASA oversaw 300 private research investigators. Nearly one third of these were international scientists. These researchers came from a wide array of Earth science disciplines. They evaluated the usefulness of Landsat data to their respective fields.

In the foreword of the U.S. Geological Survey's "ERTS-1 A New Window on Our Planet," published in 1976, then-director of the USGS, Dr. V. E. McKelvey, wrote: "The ERTS spacecraft represent the first step

in merging space and remote-sensing technologies into a system for inventorying and managing the Earth's resources."

Landsat 1 operated until January 1978, outliving its design life by five years. The quality and impact of the resulting information exceeded all expectations.

Note of Interest

Landsat 1 was built on a weather satellite platform—which is why the satellite so closely resembles the Nimbus weather satellites.

Technically, the RQ-1 Predator is not just an aircraft but an entire system. Developed as an Advanced Concept Technology Demonstration (ACTD), this system consisted of four unmanned aerial vehicles (UAVs), a ground control station, a satellite communications terminal and 55 personnel. The Predator UAV in the museum -- the most recognizable part of the system -- provided military commanders with an Intelligence, Surveillance and Reconnaissance (ISR) platform capable of flying over dangerous areas for extended periods without risk to a human pilot.

In January 1994 the Department of Defense awarded a contract for ten Predator aircraft to General Atomics Aeronautical Systems of San Diego, Calif., and the first Predator flew just six months later in July 1994. Within a year, Predators deployed to Europe, where they proved their value in operations over Bosnia from July 1995 to March 1996. In April 1996, the Secretary of Defense selected the U.S. Air Force as the operating service for the RQ-1 Predator system, and the system entered production in August 1997. In subsequent deployments, the Predator continued to demonstrate its value to military leaders.

The pre-production version Predator aircraft was designated RQ-1K, but the entire system with all the components was designated the RQ-1A. Powered by a four-cylinder, 81-hp Rotax 912 engine, the RQ-1K aircraft could cruise at 87 miles per hour for 16 hours. The production version Predator aircraft was designated the RQ 1L, and it was equipped with a turbo-charged Rotax 914 engine producing 105 horsepower.

In flight, the UAV and its on-board sensors are controlled by the ground crew with a direct data link. However, when the aircraft is flown beyond the range of a direct link, the ground crew maintains control though a satellite data link. The equipment carried in the bottom turret can provide live video, still photographs, or radar imagery in all weather conditions, day or night. Using satellite data links, the information gathered by a Predator can be shared instantaneously with commanders around the world.

Modern military commanders demand accurate and timely reconnaissance information. The RQ-4 Global Hawk high-altitude, long-endurance (HALE) unmanned aerial system (UAS) provides air, ground and sea force commanders the near-real-time reconnaissance imagery they need to defeat an enemy halfway around the world.

First flown in 1998, Global Hawk's powerful digital camera and infrared sensor gather imagery in any weather condition, day or night. Through satellite links and ground relay stations, that information is transmitted immediately anywhere in the world. Its "Synthetic-Aperture Radar/Moving Target Indicator" lets ground crews track even small, moving objects on the ground.

A typical, pre-programmed Global Hawk mission can include a 1,200-mile flight to an area of interest, 24 hours flying over the area, and the flight back to base. In just 24 hours, the RQ-4 can survey an area the size of Illinois (about 40,000 square miles) while cruising above the range of enemy air defenses.

Two small ground teams manage Global Hawk's flights: a launch and recovery element (LRE) loads flight plans and makes necessary adjustments to the vehicle while a mission control element (MCE) manages the aircraft and its sensors during flight.

Among the RQ-4's accomplishments are winning the 2000 Collier Trophy for aeronautical achievement and achieving the first autonomous UAS flight across the Pacific Ocean. This autonomous flight from

California to Australia was made in just over 23 hours. Global Hawk set a world record for jet-powered UAS endurance in 2000 by flying for more than 31.5 hours at a mean altitude of 65,100 feet.

Google Earth is a computer program that renders a 3D representation of Earth based primarily on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photography, and GIS data onto a 3D globe, allowing users to see cities and landscapes from various angles. Users can explore the globe by entering addresses and coordinates, or by using a keyboard or mouse. The program can also be downloaded on a smartphone or tablet, using a touch screen or stylus to navigate. Users may use the program to add their own data using Keyhole Markup Language and upload them through various sources, such as forums or blogs. Google Earth is able to show various kinds of images overlaid on the surface of the earth and is also a Web Map Service client. Recently Google has revealed that Google Earth now covers more than 98 percent of the world, and has captured 10 million miles of Street View imagery, a distance that could circle the globe more than 400 times.

In addition to Earth navigation, Google Earth provides a series of other tools through the desktop application. Additional globes for the Moon and Mars are available, as well as a tool for viewing the night sky. A flight simulator game is also included. Other features allow users to view photos from various places uploaded to Panoramio, information provided by Wikipedia on some locations, and Street View imagery. The web-based version of Google Earth also includes Voyager, a feature that periodically adds in-program tours, often presented by scientists and documentarians.

‘Side View’ Of A Famous Building

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[Pentagon]

Aerial view of the Pentagon

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Aerial view of a famous monument

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

[Washington Monument]

Side view of the Washington Monument

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Aerial view of a famous statue (on the lower center of the island)

NATIONAL MUSEUM
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[Statue of Liberty]

Side view of the Statue of Liberty

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Aerial view of a sporting event

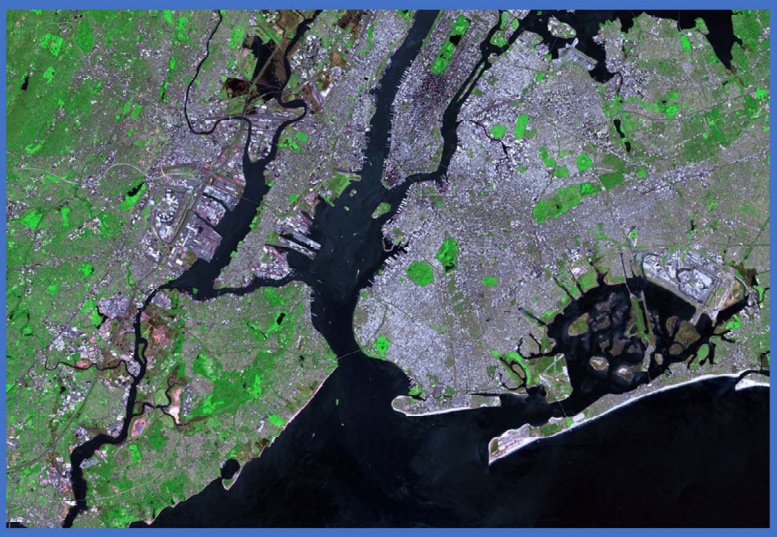
NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

[Football stadium]

Aerial view of the pyramids

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Satellite view of a famous city



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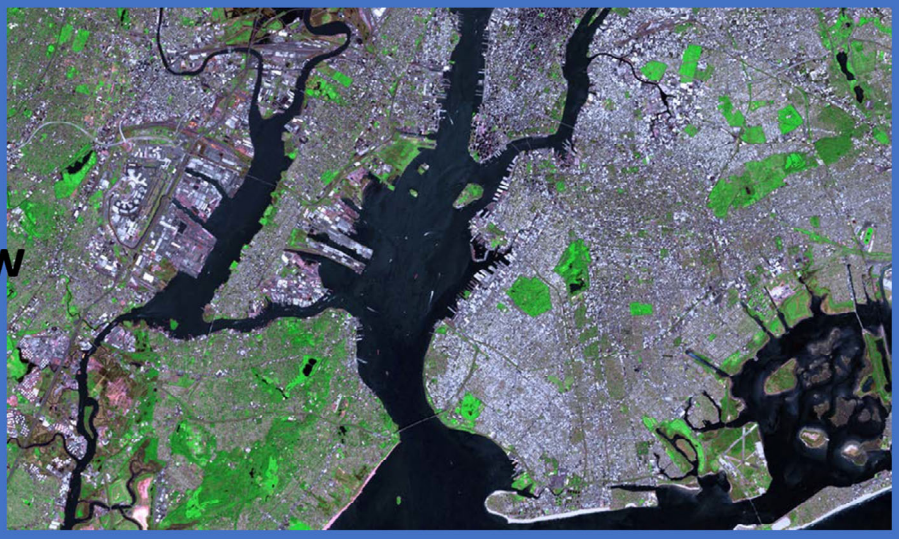
[New York City]

Closer satellite view of a famous city



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[New York City]

Satellite view of another famous city

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[Washington, DC]

Closer satellite view of a famous city

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[Washington, DC]

SR-71 side view

SR-71 front view

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A ‘BIRD’S EYE VIEW’ (REMOTE SENSING)

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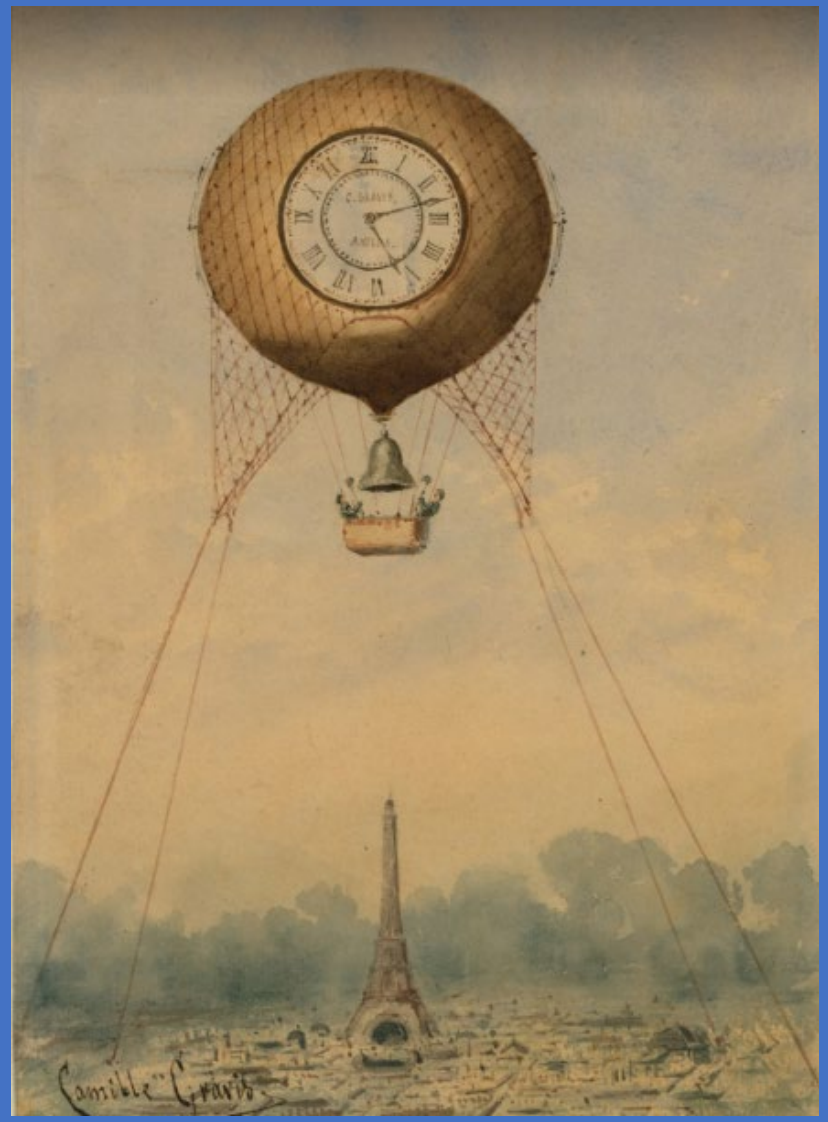
Balloons Were Used for Aerial Reconnaissance



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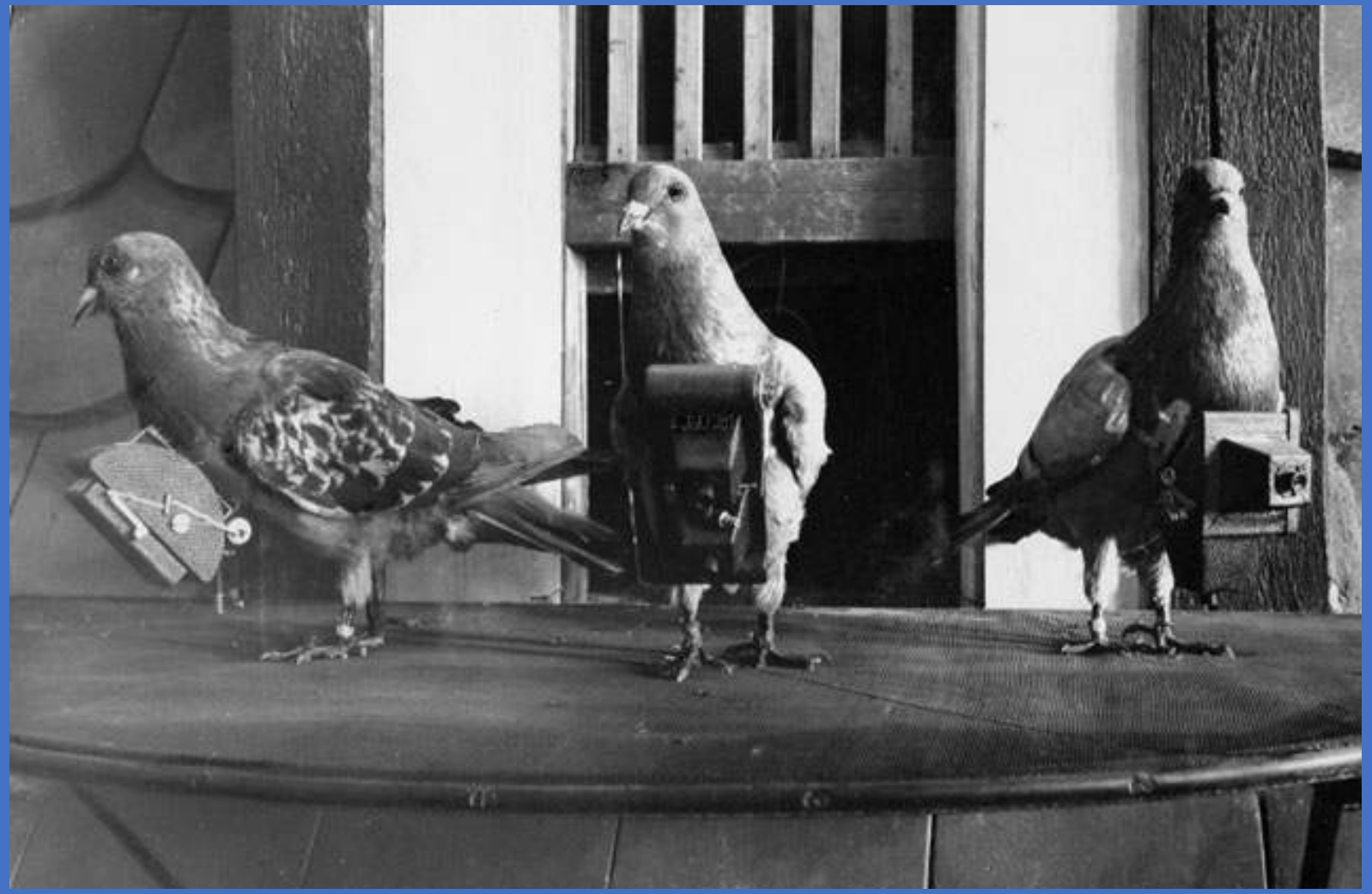
Pigeons Outfitted With Cameras



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Camera Suspended Under A Kite

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Photo Taken From A Kite (1906)

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WW I Aerial Photography

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WW II Aerial Photography

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First photo of Earth from Space: from V-2 rocket - 1946

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U-2

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Air Force C-130 Aircraft Snags a Reentry Vehicle

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SR-71

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Earth Rise

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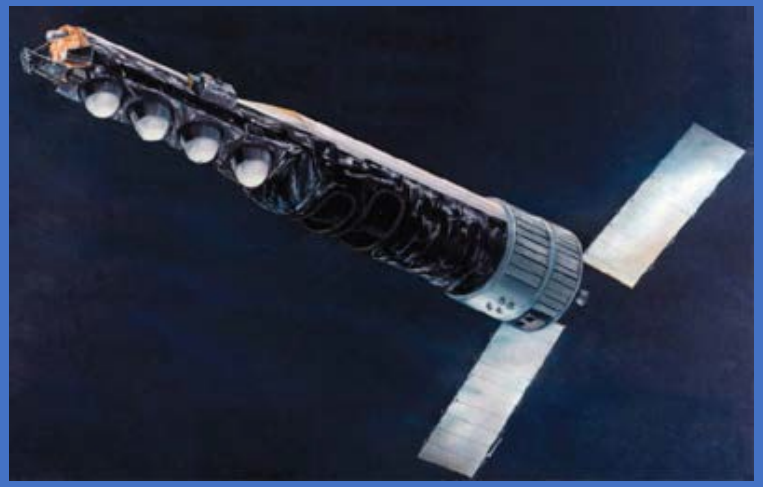
KH-9 Hexagon Reconnaissance Satellite



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Landsat 1

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Predator with camera under its nose

Global Hawk

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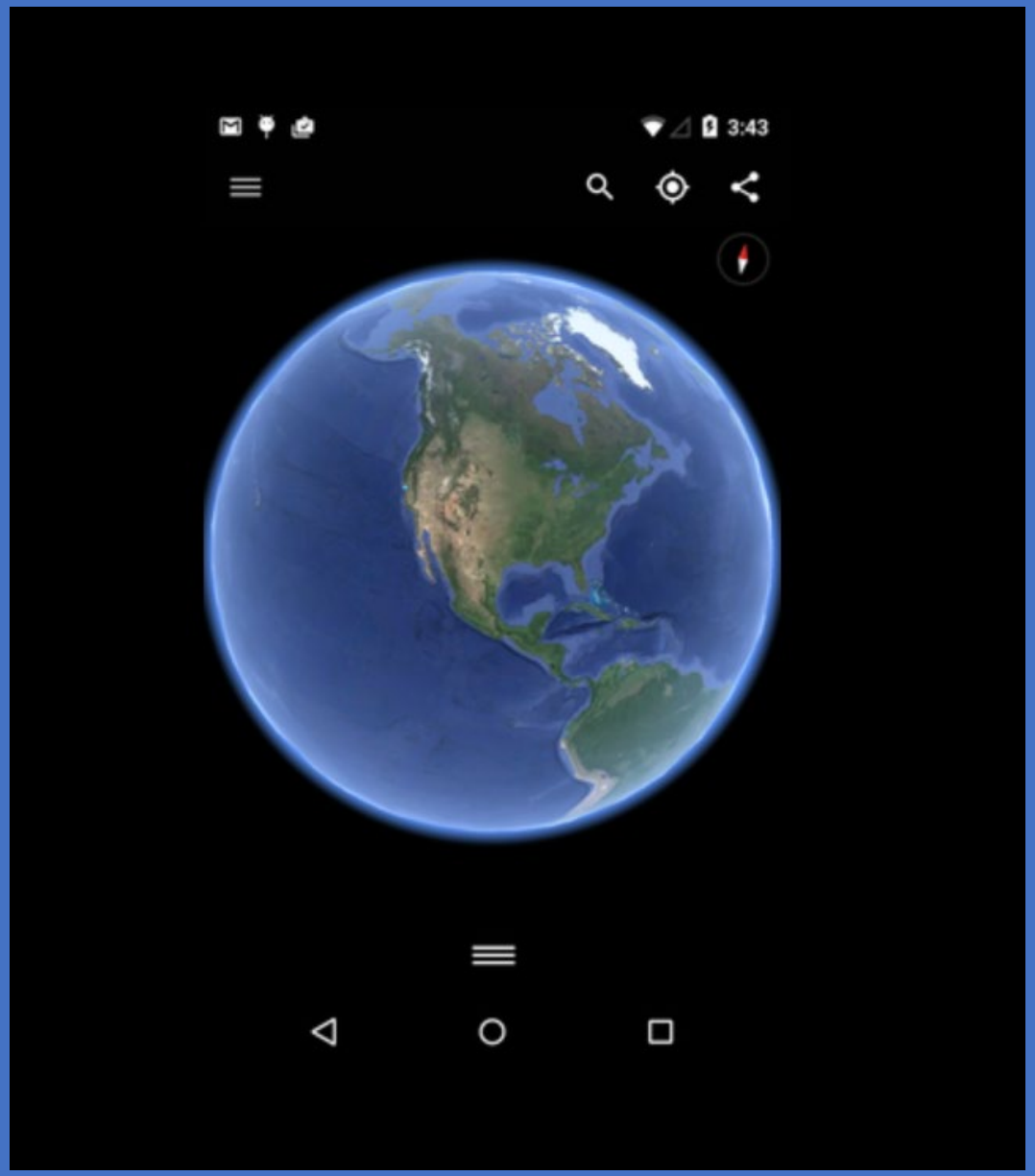
Google Earth



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‘Side View’ Of A Famous Building

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Aerial view of the Pentagon

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Aerial view of a famous monument

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Side view of the Washington Monument

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Aerial view of a famous statue (on the lower center of the island)

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Side view of the Statue of Liberty

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Aerial view of a sporting event

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Aerial view of the pyramids

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Satellite view of a famous city

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Closer satellite view of a famous city

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Satellite view of another famous city

NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Closer satellite view of a famous city

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SR-71 side view

SR-71 front view

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